

Alternate Installation Schedules

31-Plane Installation for the Far Detector

Only Block Raiser

One 8 hour Shift 5 Days per Week
Two 8 hour Shifts 5 Days per Week
Three 8 hour Shifts 5 Days per Week
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Several assumptions go into this Installation timeline. Block raiser must have one or two working platforms at the same height on rollers so the platforms can move with the block raiser. The platforms need to be designed so they can hold the load of the glue machine and a minimum of 4 module units. All of these work platforms are at the same height of the egress walkway and loading dock. This is particularly important towards the end of construction. As the loading dock area would be needed for glue process. The glue machine process requires a length of approximately 120 ft. 1 shift, 2 shift and 3 shift schedules are shown.

- **One Shift per day-22 FTE's-146 weeks total**
 - 12 week startup period since smaller number of people to hire
 - Takes one full week to build block so block can cure over the weekend before being lifted on Monday morning
 - 660 man-weeks for QA and Outfitting
 - Requires more cleanup of automatic glue machine if it is shut down each night. May be forced to have small maintenance/cleanup crew on afternoon shift.
- **Two Shifts per day-39 FTE's-89 weeks total**
 - Takes one full week to build block so block can cure over the weekend before being lifted on Monday morning
 - 620 man-weeks for QA and Outfitting
 - Requires more cleanup of automatic glue machine if it is shut down each night. May be forced to have small maintenance/cleanup crew on the midnight shift.
- **Three Shifts per day-73.5 weeks total**
 - Speeds up total installation rate
 - 542.5 man-weeks for QA and Outfitting
 - Leaves only 2 hours for glue set time before lifting plan. Since glue is not defined yet this may be wrong

Time Assumptions:

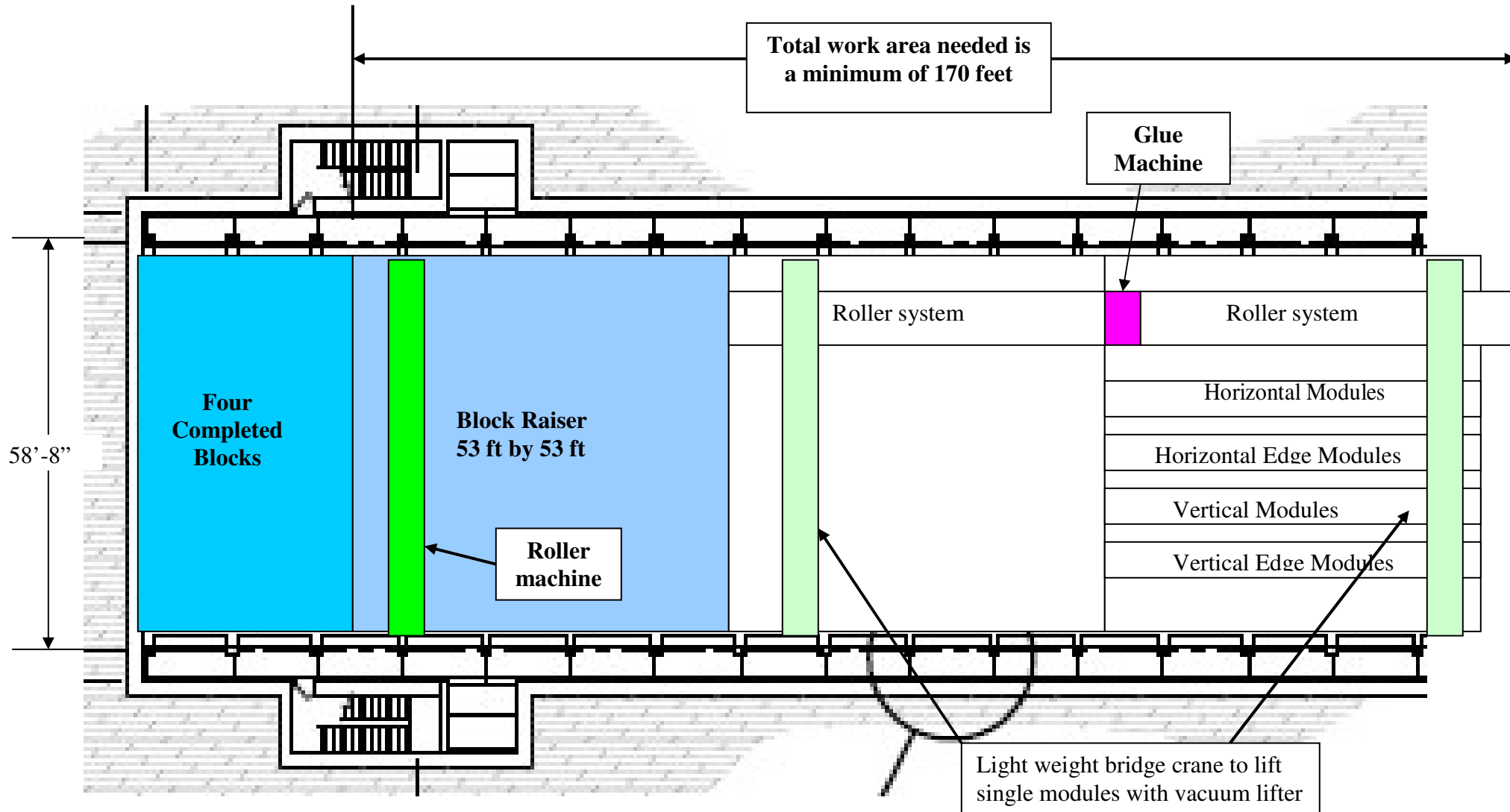
- 8 hour shifts 5 days/week
- Two hours in each shift is for lunches, breaks and work inefficiency
- Each individual module movement takes 9 minutes
- Assumes current roller machine is used on each module to insure good bonding
- Assumes edge stiffeners are glued on as separate process in module storage area or at the module factory
- 2 hours to raise and 2 hours to lower block raiser

Module Movements-Total of 9 minutes/module:

- Loading each module onto Glue Machine takes 3 minutes. Modules must be selected from one of piles and rotated in the proper orientation depending on the module needed using vacuum lifting fixture.
- Glue applying process take 3 minutes, machine is automatic.
- Module movement takes 3 minutes
- Module location takes 2 minutes-Assumes that 2 FTE's stand on module that was just put down to locate the next one.
- Roll module takes 4 minutes

Time-Minutes	Load Glue machine	Glue Process	Move modules to plane	Locate module position	Roll module
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					

- From paper time and motion study above I believe that you must still have 2 light weight bridge cranes. Since the module is automatically going through the glue machine you can not load a new module or pull the old one off until the glue process is completed or you add more length to the roller system which we don't have.



One 8 hour Shifts per Day - Total FTE's 22 – 146 Weeks

	31 plane blocks per week	Total number of blocks	Total FTE weeks
8 weeks-Setup period	0		144
12 weeks startup period	1block/3 weeks	4	172
112 weeks- full rate	1 block/ 2 week	56	2464
10 weeks ramp down	1 block/2.5 weeks	4	172
4 weeks-complete fill	0	0	100
146 weeks total		64	3052

Task	Day Shift	Afternoon Shift
Shipping and Receiving Crew	2 FTE's	2 FTE Cleanup Crew
Crane operator	2 FTE's	
Block Builder Technicians	2 FTE's	
Glue Technicians	1 FTE's	
Outfitting and QA Technicians	4 FTE's	
Scintillator Fill/Testing	2 FTE's	
Crew Bosses	3 FTE's	1 Crew Boss
Administration	3 FTE	
Total	19 FTE's	3 FTE's

At full rate each work area has 1 crew boss, 1 crane operator, 2 block builders and 1 glue technician. During 8 week setup period when assembly equipment is being erected and the 12 week ½ rate startup period crew size ramps from 6 FTE to the full crew of 22 FTE's. New crew members are added at the rate of 2 every 2 weeks so they can be trained in. It is assumed that all detector outfitting is done on the erected blocks. Each shift a team of 5 FTE's are used for installing all the cable and plumbing systems required by the electronics. Shipping and Receiving Crew is also responsible for keeping all work stations supplied with building materials. I have added a 2 FTE cleanup crew and crew boss for the night shift to clean the glue machine

**One 8 hour Shift per Day – Total 19 FTE's
Week One**

Time	Monday	Tuesday	Wednesday	Thursday	Friday
7:00	2 hours raise block	13-52 modules installed	53-92 modules installed	93-132 modules installed	133-172 modules installed
8:00					
9:00	2 hours lower block				
10:00					
11:00	1-12 modules installed				
12:00					
13:00	2 hrs/shift for lunch	2 hrs/shift for lunch	2 hrs/shift for lunch	2 hrs/shift for lunch	2 hrs/shift for lunch
14:00	Breaks, work inefficiency	Breaks, work inefficiency	Breaks, work inefficiency	Breaks, work inefficiency	Breaks, work inefficiency

Week 2

Time	Monday	Tuesday	Wednesday	Thursday	Friday
7:00	173-212 modules installed	213-252 modules installed	253-292 modules installed	293-332 modules installed	333-372 modules installed
8:00					
9:00					
10:00					
11:00					
12:00					
13:00	2 hrs/shift for lunch	2 hrs/shift for lunch	2 hrs/shift for lunch	2 hrs/shift for lunch	2 hrs/shift for lunch
14:00	Breaks, work inefficiency	Breaks, work inefficiency	Breaks, work inefficiency	Breaks, work inefficiency	Breaks, work inefficiency

Two 8 hour Shifts per Day - Total FTE's 39 – 89 Weeks

	31 plane blocks per week	Total number of blocks	Total FTE weeks
8 weeks-Setup period	0		144
15 weeks startup period	1block/2 weeks	8	416
52 weeks- full rate	1 block/week	52	2028
10 weeks ramp down	1 block/2.5 weeks	4	310
4 weeks-complete fill	0	0	100
89 weeks total		64	2998

Task	Day Shift	Afternoon Shift	Night Shift
Shipping and Receiving Crew	2 FTE's	2 FTE's	2 FTE's Cleanup crew
Crane operator	2 FTE's	2 FTE's	
Block Builder Technicians	2 FTE's	2 FTE's	
Glue Technicians	1 FTE's	1 FTE's	
Outfitting and QA Technicians	4 FTE's	4 FTE's	
Scintillator Fill/Testing	2 FTE's	2 FTE's	
Crew Bosses	3 FTE's	3 FTE	1 FTE
Administration	3 FTE	1 FTE	
Total	19 FTE's	17 FTE's	3 FTE's

At full rate each work area has 1 crew boss, 1 crane operator, 2 block builders and 1 glue technician. During 8 week setup period when assembly equipment is being erected and the 12 week ½ rate startup period crew size ramps from 6 FTE to the full crew of 39 FTE's. New crew members are added at the rate of 2-3 per week so they can be trained in. It is assumed that all detector outfitting is done on the erected blocks. Each shift a team of 5 FTE's are used for installing all the cable and plumbing systems required by the electronics. Shipping and Receiving Crew is also responsible for keeping all work stations supplied with building materials. I have added a 2 FTE cleanup crew and crew boss for the night shift to clean the glue machine

31 Plane Block Installation Schedule

2 Shifts 5 days/week

Block Raiser Only

- One nice feature of this schedule is it allows the 31 plane block to cure over the weekend.

Time	Monday	Tuesday	Wednesday	Thursday	Friday
7:00	2 hours raise block	53-92 modules installed	133-172 modules installed	213-252 modules installed	293-332 modules installed
8:00					
9:00	2 hours lower block				
10:00					
11:00	1-12 modules installed				
12:00					
13:00	2 hrs/shift for lunch	2 hrs/shift for lunch	2 hrs/shift for lunch	2 hrs/shift for lunch	2 hrs/shift for lunch
14:00	Breaks, work inefficiency	Breaks, work inefficiency	Breaks, work inefficiency	Breaks, work inefficiency	Breaks, work inefficiency
15:00	13-52 modules installed	93-132 modules installed	173-212 modules installed	253-292 modules installed	333-372 modules installed
16:00					
17:00					
18:00					
19:00					
20:00					
21:00	2 hrs/shift for lunch	2 hrs/shift for lunch	2 hrs/shift for lunch	2 hrs/shift for lunch	2 hrs/shift for lunch
22:00	Breaks, work inefficiency	Breaks, work inefficiency	Breaks, work inefficiency	Breaks, work inefficiency	Breaks, work inefficiency

Three 8 Hour Shifts per Day - Total FTE's 43

	31 plane blocks per week	Total number of blocks	Total FTE weeks
8 weeks-Setup period	0	0	144
15 weeks startup period	1block/2 weeks	8	539
36.5 weeks- full rate	1 block/10.5 shifts	52	1570
10 weeks ramp down	1/ 2.5 weeks	4	340
4 weeks-complete fill	0	0	200
73.5 weeks total		64	2793 FTE weeks

Task	Day Shift	Afternoon Shift	Night Shift
Shipping and Receiving Crew	2 FTE's	2 FTE's	2 FTE's
Crane operator	2 FTE's	2 FTE's	1 FTE
Block Builder Technicians	2 FTE's	2 FTE's	2 FTE's
Glue Technicians	1 FTE's	1 FTE's	1 FTE
Outfitting and QA Technicians	4 FTE's	4 FTE's	
Scintillator Fill/Testing	2 FTE's	2 FTE's	
Crew Bosses	3 FTE's	3 FTE	1 FTE
Administration	3 FTE	1 FTE	
Total	19 FTE's	17 FTE's	7 FTE's

At full rate each work area has 1 crew boss, 1 crane operator, 2 block builders and 1 glue technician. During 8 week setup period when assembly equipment is being erected and the 12 week ½ rate startup period crew size ramps from 6 FTE to the full crew of 43 FTE's. New crew members are added at the rate of 2-3 per week so they can be trained in. It is assumed that all detector outfitting is done on the erected blocks. Each shift a team of 5 FTE's are used for installing all the cable and plumbing systems required by the electronics. Shipping and Receiving Crew is also responsible for keeping all work stations supplied with building materials. The overall number of FTE's could be reduced after time and motion studies are done with full sized proto-types and manpower needed is better understood.

31 Plane Block Installation Schedule

3 Shifts 5 days/week

Block Raiser Only

Time	Monday	Tuesday	Wednesday	Thursday	Friday
0:00	1-40 modules installed	121-160 modules installed	241-280 modules installed	361-372 modules installed	53-92 modules installed
1:00					
2:00				2 hours prep and glue cure time	
3:00				2 hours raise block	
4:00					
5:00					
6:00	2 hrs/shift for lunch Breaks, work inefficiency	2 hrs/shift for lunch Breaks, work inefficiency	2 hrs/shift for lunch Breaks, work inefficiency	2 hrs/shift for lunch Breaks, work inefficiency	2 hrs/shift for lunch Breaks, work inefficiency
7:00	41-80 modules installed	161-200 modules installed	281-320 modules installed	2 hours lower block	93-132 modules installed
8:00					
9:00					
10:00				2 hours clean and prep block raiser	
11:00					
12:00				1-12 modules installed	
13:00					
14:00	2 hrs/shift for lunch Breaks, work inefficiency	2 hrs/shift for lunch Breaks, work inefficiency	2 hrs/shift for lunch Breaks, work inefficiency	2 hrs/shift for lunch Breaks, work inefficiency	2 hrs/shift for lunch Breaks, work inefficiency
15:00	81-120 modules installed	201-240 modules installed	321-360 modules installed	13-52 modules installed	133-172 modules installed
16:00					
17:00					
18:00					
19:00					
20:00					
21:00					
22:00	2 hrs/shift for lunch Breaks, work inefficiency	2 hrs/shift for lunch Breaks, work inefficiency	2 hrs/shift for lunch Breaks, work inefficiency	2 hrs/shift for lunch Breaks, work inefficiency	2 hrs/shift for lunch Breaks, work inefficiency
23:00					